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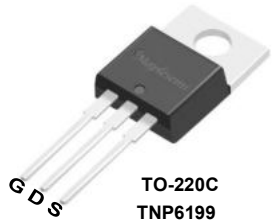
TNP6199
60V N-Channel MOSFET

General Description

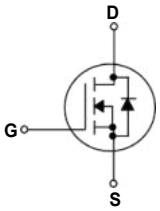
This Power MOSFET is produced using Maple semi's advanced Shielding Gate MOSFET technology.
This advanced technology has been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode. These devices are well suited for low voltage applications such as DC/DC converters and high efficiency switching for power management in portable and battery operated products.

Features

- 150A, 60V, $R_{DS(on)Typ}$ = 2.1mΩ@V_{GS} = 10 V
- Very Low On-resistance RDS(ON)
- High ruggedness
- Fast switching
- 100% avalanche tested
- Improved dv/dt capability



TO-220C
TNP6199



Absolute Maximum Ratings

T_C = 25°C unless otherwise noted

Symbol	Parameter		TNP6199	Units
V_{DSS}	Drain-Source Voltage		60	V
I_D	Drain Current - Continuous (T_C = 25℃)		150	A
	- Continuous (T_C = 100℃)		98	A
I_{DM}	Drain Current - Pulsed	(Note 1)	450	A
V_{GSS}	Gate-Source Voltage		±20	V
EAS	Single Pulsed Avalanche Energy	(Note 2)	552	mJ
E_{AR}	Repetitive Avalanche Energy	(Note 1)	240	mJ
dv/dt	Peak Diode Recovery dv/dt	(Note 3)	4.5	V/ns
P_D	Power Dissipation (T_C = 25℃)		320	W
	- Derate above 25℃		2.56	W/℃
T_J, T_{STG}	Operating and Storage Temperature Range		-55 to +150	℃
T_L	Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds		300	℃

* Drain current limited by maximum junction temperature.

Thermal Characteristics

Symbol	Parameter	TNP6199	Units
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	0.39	℃/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	62.5	℃/W

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Package Marking

Part Number	Top Marking	Package	Packing Method	MOQ	QTY
TNP6199	TNP6199	TO-220C	Tube	1000	5000

Electrical Characteristics

T_C = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
Off Characteristics						
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = 250 uA	60	--	--	V
$\triangle BV_{DSS}$ / $\triangle T_J$	Breakdown Voltage Temperature Coefficient	I_D = 250 uA, Referenced to 25℃	--	0.06	--	V/℃
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 60 V, V_{GS} = 0 V	--	--	1	uA
		V_{DS} = 48 V, T_C = 150℃	--	--	10	uA
I_{GSSF}	Gate-Body Leakage Current, Forward	V_{GS} = 20V, V_{DS} = 0 V	--	--	100	nA
I_{GSSR}	Gate-Body Leakage Current, Reverse	V_{GS} = -20 V, V_{DS} = 0 V	--	--	-100	nA
On Characteristics						
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS} = V_{GS}, I_D = 250 uA	1.0	--	2.5	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	V_{GS} = 10 V, I_D = 30 A	--	2.1	2.8	mΩ
g_{FS}	Forward Transconductance	V_{DS} = 20 V, I_D = 20 A (Note 4)	--	-	--	S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 25 V, V_{GS} = 0 V, f = 1.0 MHz	--	5460	--	pF
C_{oss}	Output Capacitance		--	2040	--	pF
C_{rss}	Reverse Transfer Capacitance		--	5.5	--	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 30 V, I_D = 30 A, R_G = 25 Ω (Note 4, 5)	--	15	--	ns
t_r	Turn-On Rise Time		--	10	--	ns
$t_{d(off)}$	Turn-Off Delay Time		--	23	--	ns
t_f	Turn-Off Fall Time		--	65	--	ns
Q_g	Total Gate Charge	V_{DS} = 30 V, I_D =30 A, V_{GS} = 10 V (Note 4, 5)	--	70	--	nC
Q_{gs}	Gate-Source Charge		--	21	--	nC
Q_{gd}	Gate-Drain Charge		--	33	--	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain-Source Diode Forward Current		--	--	150	A
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	450	A
V_{SD}	Drain-Source Diode Forward Voltage	V_{GS} = 0 V, I_S = 30 A	--	--	1.4	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0 V, I_S =30 A, dI_F / dt = 100 A/us (Note 4)	--	52	--	ns
Q_{rr}	Reverse Recovery Charge		--	68	--	nC

Notes:
1. Repetitive Rating : Pulse width limited by maximum junction temperature
2. I_{AS} =I_D, V_{DD} =30V, R_G = 25Ω, Starting T_J = 25°C
3. $I_{SD} \leq I_D$, di/dt ≤ 200A/us, $V_{DD} \leq BV_{DSS}$, Starting T_J = 25°C
4. Pulse Test : Pulse width ≤ 300us, Duty cycle ≤ 2%
5. Essentially independent of operating temperature

N- Channel Typical Characteristics

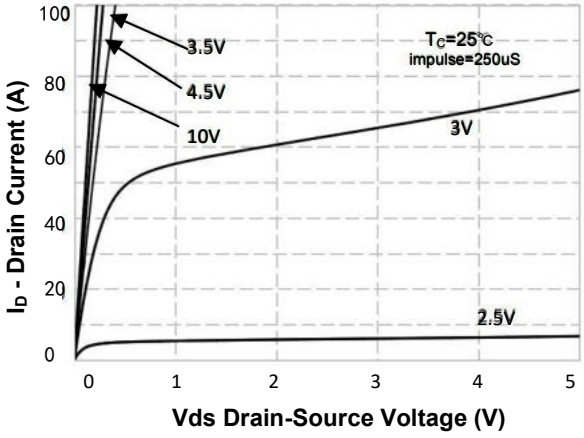


Figure 1. On-Region Characteristics

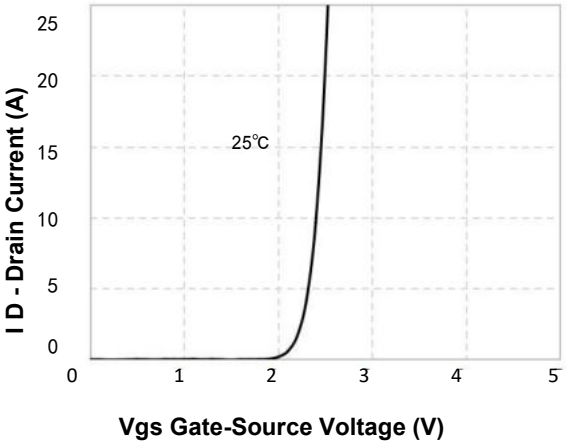


Figure 2. Transfer Characteristics

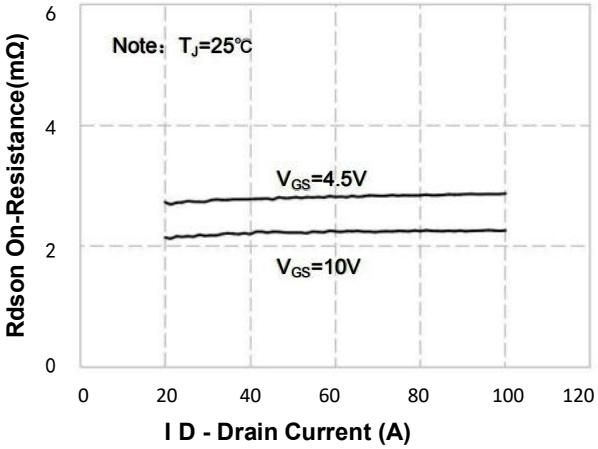


Figure 3. On-Resistance Variation vs Drain Current and Gate Voltage

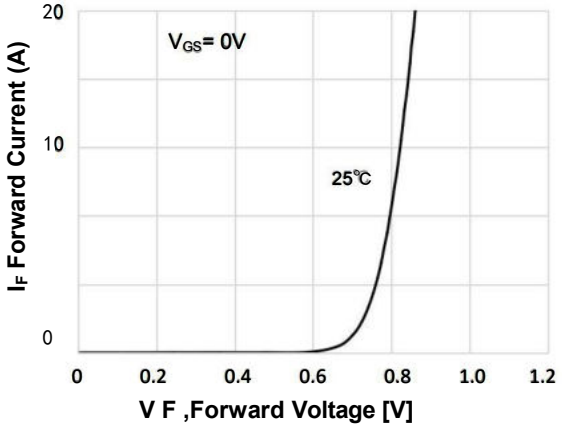


Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature

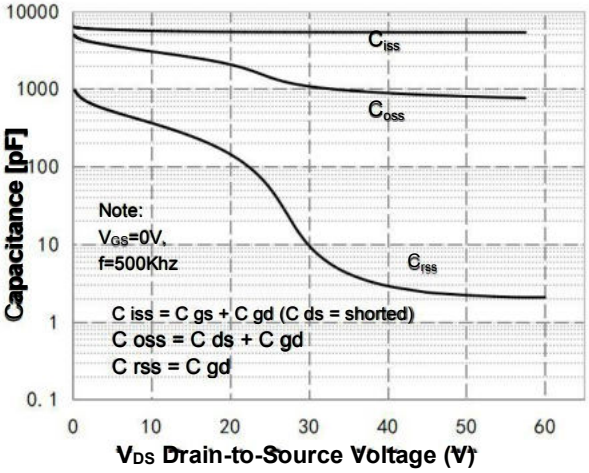


Figure 5. Capacitance Characteristics

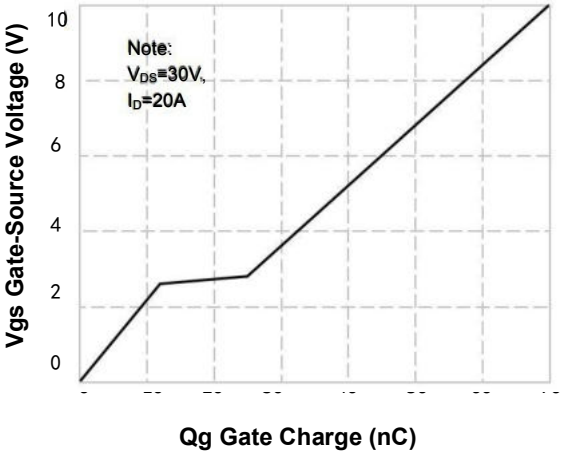


Figure 6. Gate Charge Characteristics

N- Channel Typical Characteristics (Continued)

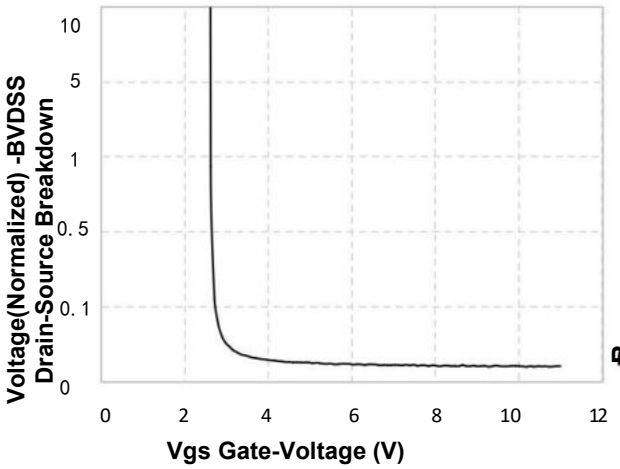


Figure 7. Breakdown Voltage Variation vs Gate-Voltage

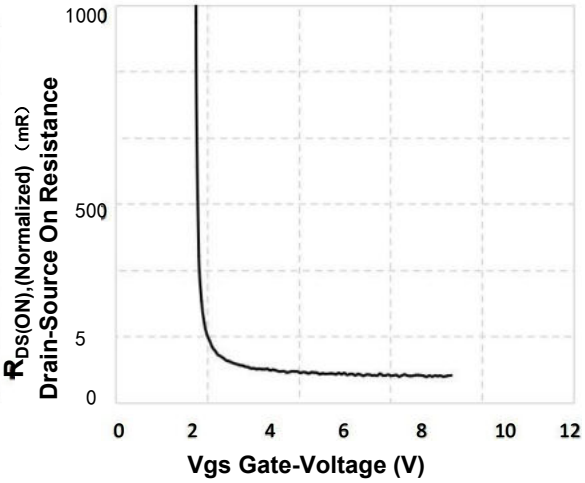


Figure 8. On-Resistance Variation vs Gate Voltage

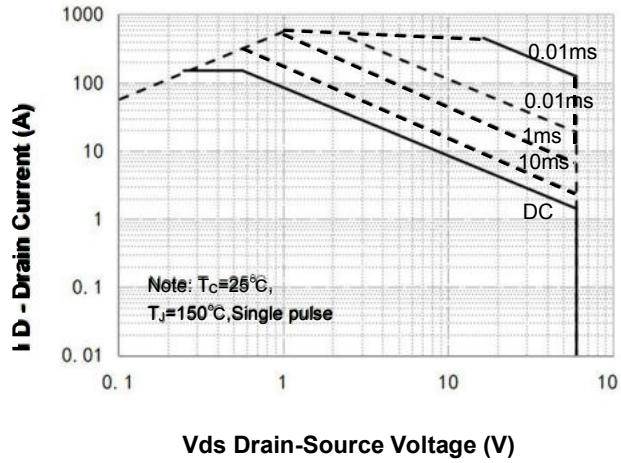


Figure 9. Maximum Safe Operating Area

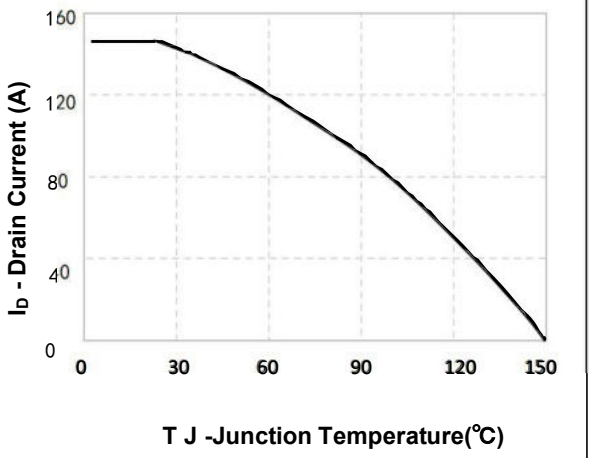


Figure 10. Maximum PContinuous Drain Currentvs Case Temperature

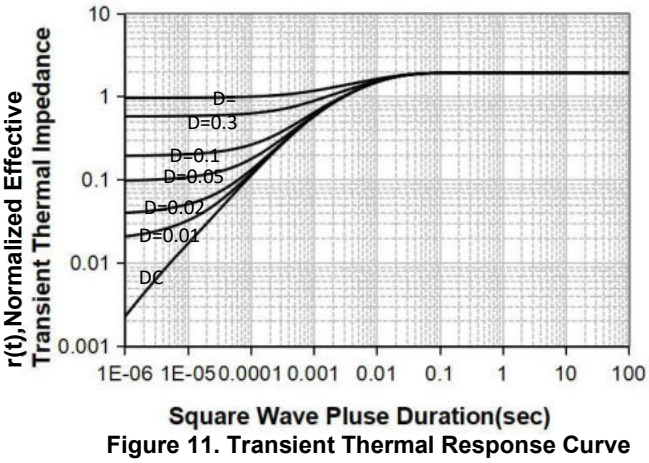
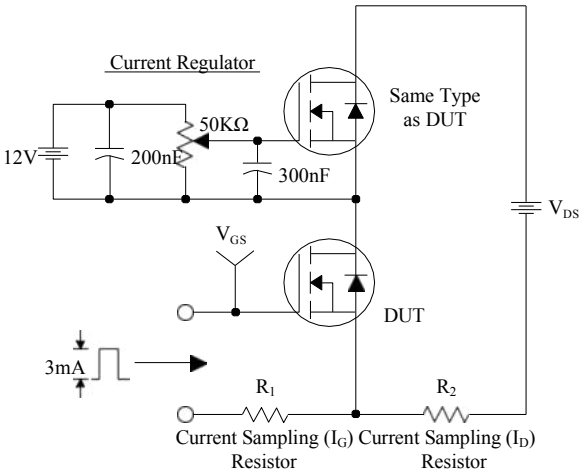
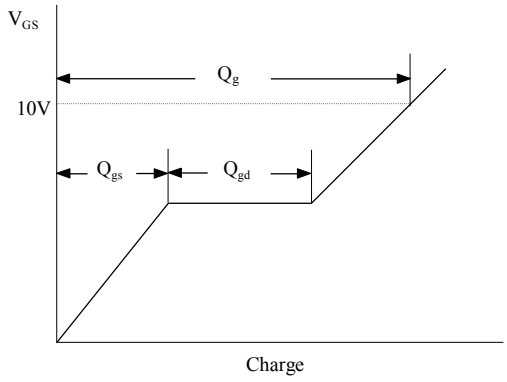


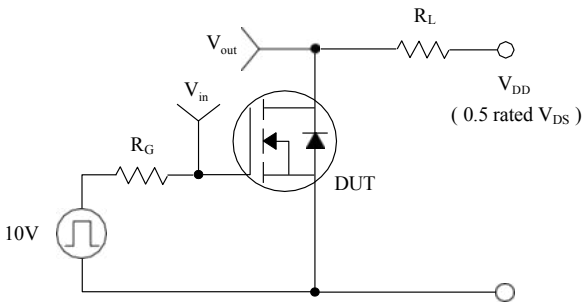
Figure 11. Transient Thermal Response Curve

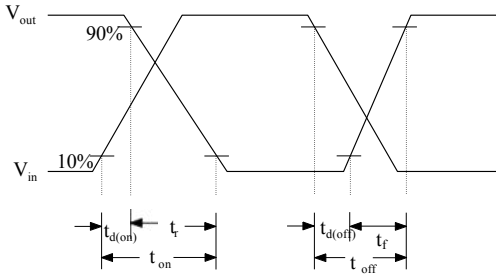
Gate Charge Test Circuit & Waveform



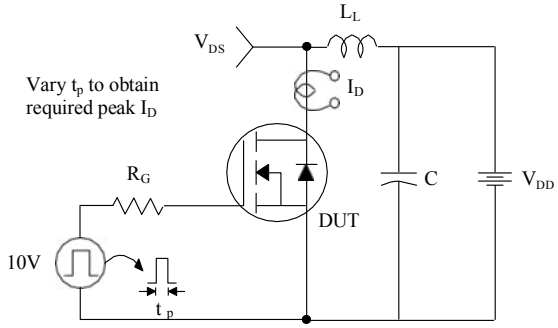


Resistive Switching Test Circuit & Waveforms

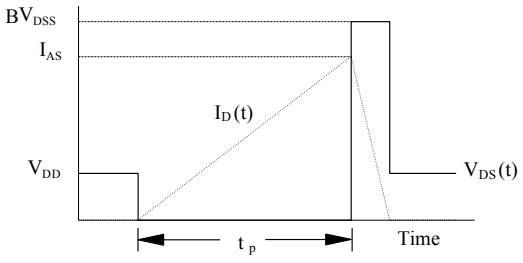




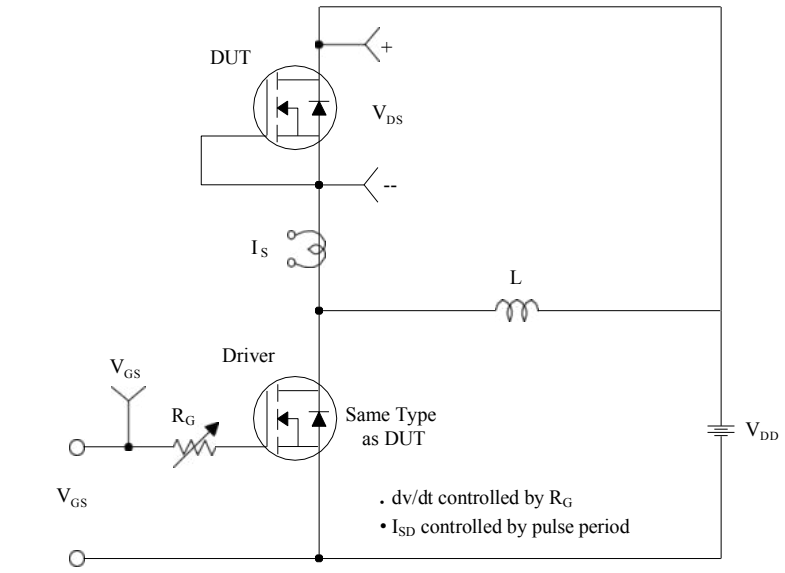
Unclamped Inductive Switching Test Circuit & Waveforms

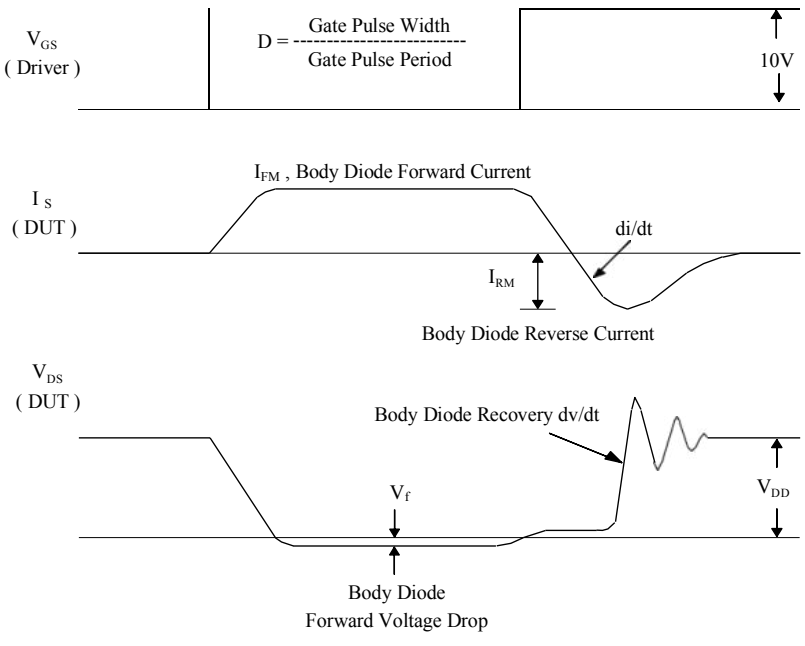


$$E_{AS} = \frac{1}{2} L_L I_{AS}^2 \frac{BV_{DSS}}{BV_{DSS} - V_{DD}}$$



Peak Diode Recovery dv/dt Test Circuit & Waveforms





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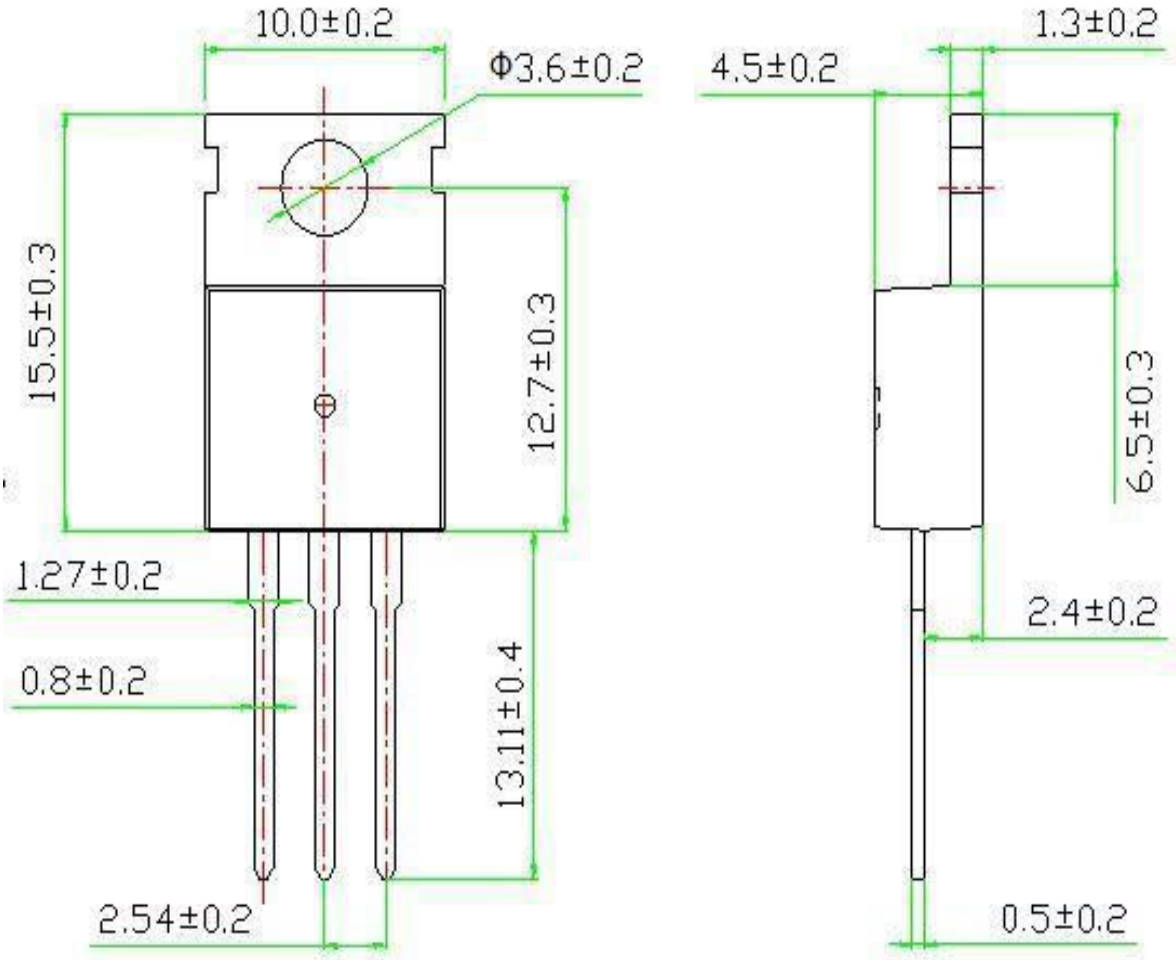
TO-220C OUTLINE



NOTE：
1The plastic package is not marked as smooth surfaceRa =0.1;Subglossy surfaceRa=0.8
2.Undeclared tolerance±0.25,Unmarked filletRmax=0.25